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This application is a continuation of application No. 09/714,440, filed on Nov. 15, 2000, now Pat. No. 6351406, which is a continuation of application No. 09/469,558, filed on Dec. 22, 1999, now Pat. No. 6185122, which is a division of application No. 09/192,883, filed on Nov. 16, 1998, now Pat. No. 6034882 .

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BACKGROUND OF THE INVENTION

1. Field of the Invention

5 This invention relates to low cost, high density semiconductor memories and, in particular, to semiconductor memories whose contents are "nonvolatile": data stored in the memory is not lost or altered when electrical power is removed.

2. Background of the Invention

10 There is an ever-increasing demand for ever-denser semiconductor memories, and customers continue to purchase these memories in ever-greater quantities, even as the number of bits per chip quadruples (approximately) every three years. Increasingly higher densities are required, at ever lower costs, to meet the needs of the marketplace.

Semiconductor nonvolatile memories may be divided into two categories: (1) those in which data is permanently written during the manufacturing process and whose contents cannot be subsequently changed, called "mask ROMs" or "factory programmed ROMs"; (2) those in which data may be supplied after the finished memory device leaves the factory.
15 This latter category is called "field programmable memories" because their contents may be written, by the user, when the semiconductor memory chip is deployed to its final application, "in the field".

Field programmable memories are further subdivided into "write once" memories and "write/erase/rewrite" memories. Those written once are referred to as "PROM" (programmable read only memories) or "OTP ROM" (one time programmable read only memories). And those memories that provide write/erase/rewrite capabilities have been referred to as "UVEPROM" (ultraviolet erasable programmable read only memories) or "EEPROM" (electrically erasable programmable read only memories) or "Flash EEPROM" (fast and flexible EEPROMs). In contrast, the contents of mask ROMs are permanently

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